

line 4, after "characteristics" replace "with" by  
--and having--, after "removed" replace "  
and" by --therefrom,--;  
line 5, after "easily" replace "in" by --during--;  
line 6, after "growth" delete "is provided", after  
"method" delete "of preparing a carbon-";  
line 7, replace the line to read: --includes--;  
line 10, replace the line to read: --filled  
crucible--;  
line 11, before "within" delete "boron oxide";  
line 13, before "material" insert --raw--;  
line 14, after "compound" insert --raw--.

REMARKS:

- 1) The entire specification has been amended in an editorial manner to improve the use of idiomatic English grammar and the readability of the originally filed text, which was a translation from a corresponding Japanese text. All of the amendments are supported by the substance and context of the original disclosure, and no new matter has been added. The original claims 1 to 20 have been amended in an editorial and formal manner, to more clearly set forth the subject matter of the invention in accordance with 35 U.S.C. §112, and to better adapt to U. S. conventions. No new matter has been added.
- 2) New claims 21 to 23 have been added, to recite additional features that were originally disclosed but not expressly recited

in the claims. The new claims are supported by the original disclosure as follows, and do not introduce any new matter.

New Claims	21	22	23
Original Disclosure	Pg.14, ln.23- Pg. 15, ln.2	Pg.7, ln.6-11; Pg.21,ln.12-15	Pg.11, ln.14-17; Pg.12, ln.6-8; Pg.24, ln. 10- Pg.25, ln. 2; Table 10 on Pg. 26, particularly Example 4

- 3) Referring to the copy of applicants' Form PTO-1449 dated April 25, 1997 enclosed with the Office Action, it is noted that the Examiner has not initialled Reference "AE", perhaps by an oversight. To ensure that Reference "AE" is printed on the face of any patent issuing from this application, the Examiner is respectfully requested to initial the reference, and return a fully initialled copy of Form PTO-1449 dated April 25, 1997 together with the next official communication.
- 4) The Examiner's attention is also directed to applicants' Information Disclosure Statement of November 6, 1997. The Examiner is respectfully requested to consider the cited references, and to return a fully initialled, signed and dated copy of applicants' Form PTO-1449 dated November 6, 1997 together with the next official communication.
- 5) Referring to the "Notice of References Cited" (Form PTO-892) enclosed with the Office Action, it is noted that additional references were enclosed with the Office Action, but were not listed on the Form PTO-892. The additional references are computer printouts of abstracts and reference information, appar-

ently resulting from a computer search carried out by the Examiner. These additional references include:

Japanese Patent Publication JP 01-037833 A2 (Yamamoto et al.) of Nippon Mining Co., Ltd.;

A. Hruban et al. "Influence of Carbon Doping on Physical Properties of SI GaAs", Proceedings of the SPIE, 1995, Vol. 2373, pages 313 to 316; and

Y. Otoki et al., "Properties of Metal-Semiconductor Field-Effect Transistors Fabricated on Carbon-Doped Semi-Insulating GaAs Crystal Grown by Liquid Encapsulated Czochralski Method", Japanese Journal of Applied Physics, Part II, September 15, 1993, Vol. 32, No. 9B, pages 1297 to 1299.

Since it is apparent that these additional references were considered by the Examiner, it is respectfully requested that these references should be listed on a Form PTO-892 so that they are printed on the face of any patent issuing from this application.

- 6) Referring to the section entitled "Priority Under 35 U.S.C. §119" in the "Office Action Summary", the certified copy of the priority document Japanese Patent Application No. 8-107009 is enclosed herewith. The Examiner is respectfully requested to acknowledge receipt of the priority document.
- 7) Referring to section 1 on page 2 of the Office Action, the Examiner is hereby notified that 7 sheets of drawings including 8 figures thereon were filed together with the application on April 25, 1997, as evidenced by the corrected Official Filing Receipt and our return receipt postcard for the original application (copies of which are enclosed). For the Examiner's convenience, applicants are enclosing a duplicate copy of 7 sheets of drawings including Figs. 1 to 8 thereon. The presently enclosed duplicate or replacement drawings are exact copies of the drawings that

were originally filed, and therefore do not involve any new matter.

- 8) The Examiner is respectfully requested to enclose a copy of the Notice of Patent Drawing Review (PTO-948) together with the next official communication.

- 9) In view of the rejections that will be discussed below, applicants are also enclosing:

a certified, true and accurate English translation of the priority document (Japanese Patent Application No. 8-107009) on which the present U. S. application relies for the priority benefit under 35 U.S.C. §119;

the complete English text of the Kawase et al. article "Low-dislocation-density and Low-residual-strain Semi-insulating GaAs Grown by Vertical Boat Method" of which the Abstract has been applied as a reference by the Examiner; and

certain reference material relating to the 1996 IEEE Semi-conducting and Semi-Insulating Materials Conference (IEEE SIMC-9), conducted from April 29, to May 3, 1996 in Toulouse, France, in which the Kawase et al. article was publicly presented and made publicly available for the first time.

- 10) Applicants' hereby reassert the claim to the priority date of April 26, 1996 for the present application under 35 U.S.C. §119 and 37 C.F.R. §1.55. To perfect their priority claim, applicants are now submitting the presently enclosed English Translation of the priority document. From the English translation, it is apparent that the priority document fully supports and discloses

the same invention as presently claimed. Thus, the present claims are entitled to the priority date of April 26, 1996.

- 11) The Kawase et al. article "Low-dislocation-density and Low-residual-strain Semi-Insulating GaAs Grown by Vertical Boat Method" was first published not earlier than April 29, 1996 at the IEEE SIMC-9 Conference.

The publication date of April 29, 1996 is indicated in the Examiner's computer print-out Abstract of the reference, and is evidenced by the enclosed reference materials relating to that conference. The article was presented and examined as a part of the "Proceedings of the Ninth Conference on Semiconducting and Insulating Materials" which took place April 29 to May 3, 1996. The proceedings publication was then forwarded to recipients by mail about one year later. It is also noted that the English text of the Kawase et al. article itself, as enclosed herewith, indicates a date of "6/96".

As such, the article was first published after the presently claimed priority date of April 26, 1996, and less than one year before the U. S. filing date of April 25, 1997 of the present application. For these reasons, the Kawase et al. article cannot be used as a prior art reference under 35 U.S.C. §102(a) or §102(b). On this basis, the Examiner is respectfully requested to withdraw the Kawase et al. article from applicability as a prior art reference.

- 12) It is also noted that the Kawase et al. article describes the inventive efforts of the inventors identified in the present application. The two inventors named in the present application (Tomohiro Kawase and Masami Tatsumi) are co-authors of the Kawase

1

et al. article reference and made all of the inventive contributions thereto. The other co-authors of the article reference were not inventors of the subject matters described therein that overlap with the subject matter presently being claimed, and did not directly contribute to the presently claimed invention. For this reason (see M.P.E.P. §715.01(c), §716.10 and §2132.01), the Kawase et al. article cannot be used as a prior art reference under 35 U.S.C. §102(a).

- 13) Referring to sections 3 to 6 on pages 3 to 5 of the Office Action, the rejection of all claims 1 to 20 as obvious over U. S. Patent 5,515,810 (Yamashita) in view of the Kawase et al. article, and further in view of U. S. Patent 5,131,975 (Bourret-Courchesne) with regard to claims 2, 10 and 11, are respectfully traversed because the Kawase et al. article cannot properly be applied as a prior art reference.

Most importantly, as discussed above, the publication date of the Kawase et al. article is later than the priority date of April 26, 1996 that has been claimed for the present application, and is less than one year before the U. S. filing date of April 25, 1997. Secondly, the Kawase et al. article is a publication of the present inventors' own invention.

Each one of the rejections asserted by the Examiner relies on the disclosure of the Kawase et al. article. Once the Kawase et al. article is removed as not being a proper prior art reference, the rejections are obviated. Therefore, the Examiner is respectfully requested to withdraw the rejections.

- 14) Moreover, the present invention is patentably distinguishable over the asserted references on substantive grounds.

Claim 1 is directed to a method of preparing a carbon-doped group III-V compound semiconductor crystal including particular method steps. The method includes a step of placing a raw compound material, a solid carbon material, and a boron oxide substance together into a crucible or boat. Then the compound raw material is heated or melted in the crucible or boat.

The Examiner has not addressed this important feature of placing a solid carbon material directly into the crucible or boat together with the compound a raw material and a boron oxide substance. The references, even when viewed in combination, do not suggest such a step. For this reason, the present invention would not have been obvious from the combined teachings of the references, and the Examiner is respectfully requested to withdraw the rejections.

- 15) The new dependent claims 21 to 23 recite additional features that further distinguish the invention over the prior art.

Claim 21 recites that the method further comprises having the melted boron oxide substance in contact with the melted compound raw material during the step of heating and melting the compound raw material. Thus, the boron oxide substance is in contact with both the solid carbon and the melted compound raw material, and thereby the carbon becomes incorporated or doped into the compound raw material forming the crystal.

Claim 22 recites a further step of selecting a target amount of carbon that is to be doped into the compound semiconductor crystal, and then adjusting the amount of carbon placed into the crucible or boat so as to achieve the selected target amount of carbon doped into the semiconductor crystal. In this manner, the

carbon doping concentration can be easily adjusted by adjusting the amount of solid carbon placed into the crucible or boat.

Claim 23 recites that the method is carried out in such a manner that the carbon concentration in the semiconductor crystal varies by not more than 8½ percent relative to the lowest carbon concentration. This extremely uniform carbon concentration can be achieved by carrying out the inventive method steps, and is considerably improved over the prior art (see e.g. Table 10 on page 26 of the present specification).

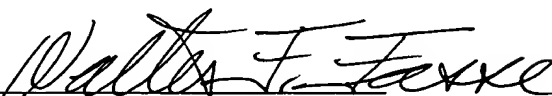
The features of new claims 21 to 23 discussed above are not suggested by the prior art references. Entry and favorable consideration of the new claims are respectfully requested.

- 16) Favorable reconsideration and allowance of the application including all claims 1 to 23 are respectfully requested.

Respectfully submitted,

Tomohiro Kawase et al.  
Applicant

WFF:ar/3442  
Encls.: postcard,  
Priority Doc. No. 8-107009,  
copy of:  
OFR, postcard of 4/25/97,  
originally filed drawings,  
translation of JP 8-107009,  
trans. Declaration,  
English text of Kawase et al.,  
reference material relating to  
"1996 IEEE SIMC-9" conference

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